ROTATING THROAT RETROFIT FOR MPS 89G MILL

PERFORMANCE EVALUATION

For

INTERMOUNTAIN POWER SERVICE CORP.

DELTA UNIT 1

Project No. 350052
Contract No. 201042

DATE ISSUED: January 5, 2004

Project Report

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Performance Evaluation

For:

Intermountain Power Service Corp.

Delta Unit 1

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Delta Unit 1

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Intermountain Power

Phil Hailes/James Nelson (3 copies)

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1.0 Background and Objectives

RPI was contracted to develop a rotating throat for B&W MPS 89G mill for Intermountain Power (IP), Delta Unit 1. The primary goal of developing RPI's rotating throat for IP is to allow the existing B&W MPS 89G mill to operate with 95% feeder speed with a limitation in PA duct pressure of 44 iwc. With this mill capacity, IP is capable of operating six (6) mills to meet MCR coal flow demand, instead of currently seven (7) mills in service. The specific objectives to improve the mill performance with the RPI rotating throat, which were listed in RPI proposal No 501103 Rev. 2 dated July 23, 2003, are as follows.

- 62 tph (95% feeder speed) mill throughput [1]
- Coal fineness of 73%± thru 200 mesh
- Pressure differential not greater than 21 iwc between primary air inlet and classifier inlet. (does not include classifier dP)
- Cap of 44 iwc duct pressure
- Power consumption less than or equal to 70 amps of main motor
- Minimize reject rate

(1) 62 tph is the throughput specification in the proposal. However, 64 tph (95% feeder speed) is the throughput that satisfies IP.

2.0 RPI Design Basis

Total B&W MPS mill system pressure resistance primarily consists of mill pressure differential, coal pipe and burner pressure differential. All pressure differentials are a function of primary air (PA) flow. Within the design range, the lower the PA flow, the less the pressure differential of a mill system will be. The mill pressure differential mainly comprises pressure losses from throat nozzle, coal fluidized bed above the nozzle and the classifier. At a given mill throughput, harder coal and/or finer than standard coal fineness will increase coal particle circulation rate within the mill and thus increase mill pressure differential.

In order to maximize the reduction in mill system resistance to meet the requirement for capping the PA duct pressure at 44 iwc, RPI designed and sized the rotating throat with two approaches. One is to minimize mill PA flow; another is to decrease throat nozzle velocity within limits to maintain proper fluidization characteristics. Minimizing PA flow will reduce overall mill system pressure resistance from the mill inlet to burners, while decreasing the throat nozzle velocity will reduce the dP across the throat. At a specified throat nozzle velocity, the nozzle flow section area has to become smaller as PA flow is reduced.

Based on BBPS throat sizing standard, the recommended maximum throat nozzle velocity range is 80 - 95 m/s, while the minimum required throat nozzle velocity is about 70 m/s at full mill load, to prevent coal from rejecting through the nozzle and into the pyrites chamber or mill windbox below. To enhance throat operation flexibility, the RPI throat for IP was designed with the capability to adjust the throat nozzle opening area, which enables the throat to operate at the velocity between 71 m/s to 80 m/s, based on preliminarily designed A/C ratio of 1.7 for full mill load.

In principle, the configuration of RPI's rotating throat employed standard BBPS rotating throat design criteria except for rotating ledge cover that has been successfully applied on the MPS 170 mill in Mitsui Project (RPI Contract 96201) and bell-shaped nozzle inlet which IP requested, as well as attachment mechanism to adapt B&W MPS 89G mill configuration and mounting dimensions. This prototype throat was made from carbon steel, and the nozzle in segments was cast rather than fabricated as normal practice due to the bell-shaped nozzle inlet requirement.

3.0 Findings

3.1 Delta Unit 1, 1E mill was retrofitted with RPI rotating throat in the mid of July 2003. On July 2, 2003, a pre retrofit mill test was performed for the existing mill and throat (stationary) worn condition. With 44.6 iwc PA duct pressure, the maximum achievable mill load during this pre retrofit testing was 54.4 tph (80% feeder speed). At 50.6 tph (74% feeder speed) mill load, the mill operated at 17.8 iwc pressure differential. The A/C ratio was 2.2 with 5.1% PA flow bias setup. The mill motor amps for 50.6 tph mill load were 72.5 amps.

3.2 The post retrofit mill test with RPI rotating throat installed was conducted on November 11, 2003. The throat nozzle was setup at maximum opening area for the testing. The highest steady mill load tested was 61.4 tph at 44.1 iwc PA duct pressure. No further increase for mill load was tested due to the PA flow choking at the capped PA pressure of 44 iwc. Ultra fine coal fineness shown in Table 1 was obtained at this mill load condition.

Table 1. Coal Fineness Data

Coal fineness	50 mesh	100 mesh	200 mesh
% passing through	100	98.0	79.1

The other operating parameters and mill loads tested are listed as follows in Table 2.

Table 2. Post Retrofit Testing Results

Feeder speed	90	88	85	80	75
Coal flow, t/hr	61.4	60.1	58.3	55.1	51.3
Primary air flow, (PA), Klb/hr	182.5	190	207	214	215
A/C ratio	1.49	1.58	1.78	1.94	2.10
Motor amps	76.4	73.2	71.7	71.4	70.5
Mill dP, iwc	27.3	26.8	25.8	24.3	21.3

3.3 The increase in mill dP is a key factor to prevent the mill from being tested at higher mill loads. At reduced mill loads, say at 50 tph, the mill with RPI rotating throat has higher mill dP than other mills for the current mill A/C ratio characteristic. This is no surprise since the RPI throat was designed purposely to reduce nozzle opening area for minimizing PA flow. With the current mill A/C characterization, the mill operates at PA flow higher than the RPI throat required, which results in higher throat nozzle velocity as designed and thus produces higher pressure differential across the throat. If the mill were re characterized to produce RPI's recommended design air to coal characteristic, mill dP would reduce.

3.4 On the other hand, coal fineness analysis indicated the lower PA flow operation allowed the mill to produce ultra fine coal product during the testing. Ultra fine coal fineness typically requires more mill power consumption, and increases coal particle circulation rate within the mill. This creates higher dP in the mill and classifier. A decrease in mill dP up to 2 to 3 iwc could be expected by adjusting the classifier

directional vanes setup to detune the classifier and decrease coal fineness from 79.1 % < 200 mesh to IP's specified 73% < 200 mesh in the proposal. It is possible that resulting mill dP reduction will allow the mill to achieve the throughput of 64 tph at the given 44 iwc PA duct pressure.

3.5 Based on RPI MPS mill engineering standards for RPI's rotating throat, the mill pressure differential, at tested mill load of 61.4 tph and resultant ultra coal fineness, is approaching 30 to 32 iwc (including classifier dP). It is predicted that with standard RPI throat design, the mill dP at the mill load of 64 tph and coal fineness of 73% < 200 mesh will be 28 to 30 iwc (including classifier dP). This implies that with standard RPI rotating throat design, there is little margin for PA duct pressure when the mill operates at the load of 64 tph at the given 44 iwc PA duct pressure limit. Additionally, mill to burner pressure differential increased up to 2 iwc since the initial proposal was developed, because variable orifices were installed during an outage last summer. This makes the margin even tighter.

3.6 The current B&W MPS 89G mill rating capacity is 68 tph at standard fuel and coal fineness. The corrected mill capacity with unworn mill grinding elements will be approximately 63 tph when burning coal of 48.5 HGI and with 6.8% moisture content, and at the specified coal fineness of 73% < 200 mesh. When the mill operates at the capacity higher than this corrected capacity, a significant coal particle circulation within the mill will be generated due to insufficient mill grinding capacity to produce the required coal capacity with the qualified coal fineness passing through the classifier. The increase of coal particle internal circulation requires additional support from PA duct pressure. If the given 44 iwc PA duct pressure is insufficient to meet this requirement, the PA flow will be choked (coal internal circulation rate increases further) to reach a new equilibrium mill operating condition. The mill has to be shut down eventually as the mill load continues to increase, because of the incapability of PA to convey the coal and /or unacceptable coal reject rate through the throat. Obviously, the solution to deal with this situation is either to increase the mill grinding capability by retrofitting the mill or to decrease coal fineness by adjusting the current classifier setup. Another option is to increase mill classification efficiency through a dynamic classifier, rather than the rotating throat or increase in PA duct pressure. The mill capacity evaluation and testing results, to date, indicate the mill at 64 tph load with specified coal fineness of 73% < 200 mesh will be operating around this situation, while the mill load of 61.4 tph with the coal fineness of 79.1 % < 200 mesh during the mill testing is equivalent to 67 tph theoretically when converting the coal fineness of 79.1% < 200 mesh to that of specified 73% < 200 mesh. This is approximately 6.3% higher than corrected mill capacity of 63 tph.

4.0 Conclusions

4.1 RPI approached the rotating throat design with the intent of minimizing rotating throat and mill system dP by two steps 1) the design criteria for nozzle sizing was based on reducing the throat velocity, and 2) the rotating throat was designed to operate at a lower A/C ratio than all current throat designs. This lower PA flow (lower A/C ratio) requirement not only reduces mill system pressure resistance from the mill to burners but also positively affects erosive wear in the upper mill housing and burners / burner lines when firing the coal with a large amount of rock.

4.2 The mill testing demonstrated that the RPI rotating throat is capable of achieving the mill capacity of 61.4 tph with ultra coal fineness of 100% < 50 mesh, 98% < 100 mesh and 79.1 % < 200 mesh. This capacity is approximately 13% higher than measured during pre retrofit testing on this same mill. However, the achieved mill capacity does not meet the mill capacity of 64 tph at 95% feeder speed as IP desired due to the high mill dP and 44 iwc PA duct pressure limit. The mill dP can be reduced by decreasing the current ultra coal fineness to the specified objective coal fineness of 73% < 200 mesh, through adjustment of classifier directional vanes. It is possible that Mill 1E with the RPI rotating throat can achieve the capacity of 64 tph after the classifier directional vane adjustments are implemented and the mill is re characterized to reduce the current mill PA flow to the design PA flow rate for the RPI throat. The mill re characterization will also lower the mill dP at reduced mill loads.

4.3 RPI's analysis indicates that the mill will be running at its maximum capacity or higher when producing 64 tph coal with specified coal fineness of 73% < 200 mesh. At this throughput, the mill may exceed its capacity margin, and will potentially operate at an unstable condition, particularly when the mill grinding elements are in a worn condition and considering fluctuation in coal properties.

4.4 The RPI rotating throat with minimum required PA flow design allowed the mill to produce ultra fine coal fineness. This lower PA flow requirement will contribute to more PA system margin for IP since other mills at worn throat condition require bias PA setup for higher PA flow.

5.0 Recommendations

5.1 Further mill testing is required to conclude if the 1E mill equipped with the RPI rotating throat will produce the coal throughput of 64 tph as IP desired. The directional vanes in the mill classifier need to be adjusted to decrease coal fineness from the current obtained ultra coal fineness for the mill throughput increase. The throat inspection is recommended before performing the test.

5.2 Deviation from the RPI rotating throat design standard may be required to develop a rotating throat specific to IP requirements. Since the design margin is so tight at the given 44 iwc PA duct pressure, comprehensive mill testing of Mill 1E is required to collect detailed design information for this development effort. With the obtained design information, RPI can develop a rotating throat to meet IP's requirement, unless the testing proves the mill grinding capacity, rather than mill dP, is a dominant factor to prevent the mill from achieving the desired throughput at the specified coal fineness.

5.3 To benefit from a lower PA flow requirement with the RPI rotating throat design, re characterizing 1E mill is recommended to reduce the PA flow rate to the design PA flow range for the throat operation. Based on the mill testing results collected to date, preliminary mill characterization curves are attached. These curves need to be finalized and tuned with further mill testing and then incorporated into the mill control philosophy.

5.4 Considering the tight or potentially non existing margin on the mill grinding capacity, the rotating throat plus RPI's SLS dynamic classifier retrofit could be an ultimate solution for IP to have six mills in service for the MCR fuel demand. The dynamic classifier not only increases the mill capacity by improving the mill classification efficiency but also provides the mill real-time coal fineness control capability. This will allow mills to produce ultra fine level of coal fineness when seven (7) mills in service to significantly reduce LOI and meet coal demand with six (6) mills in service, as well as to improve coal distribution between coal pipes for better emission control.

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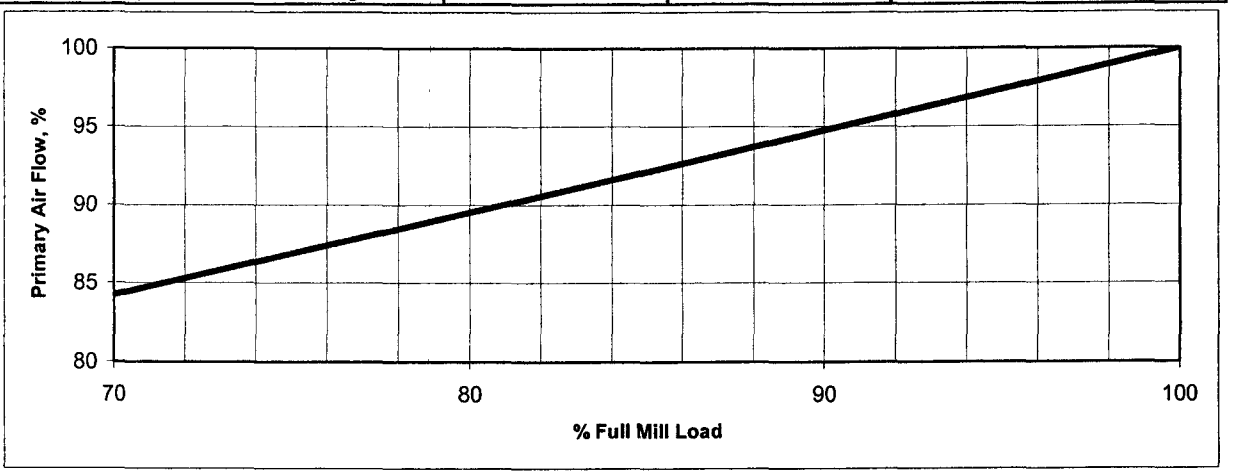
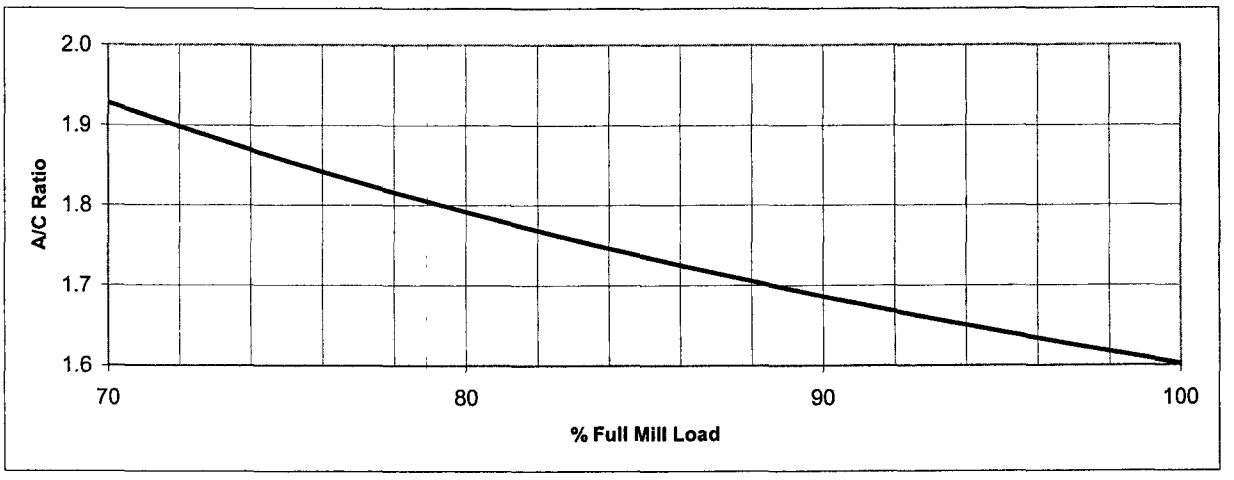
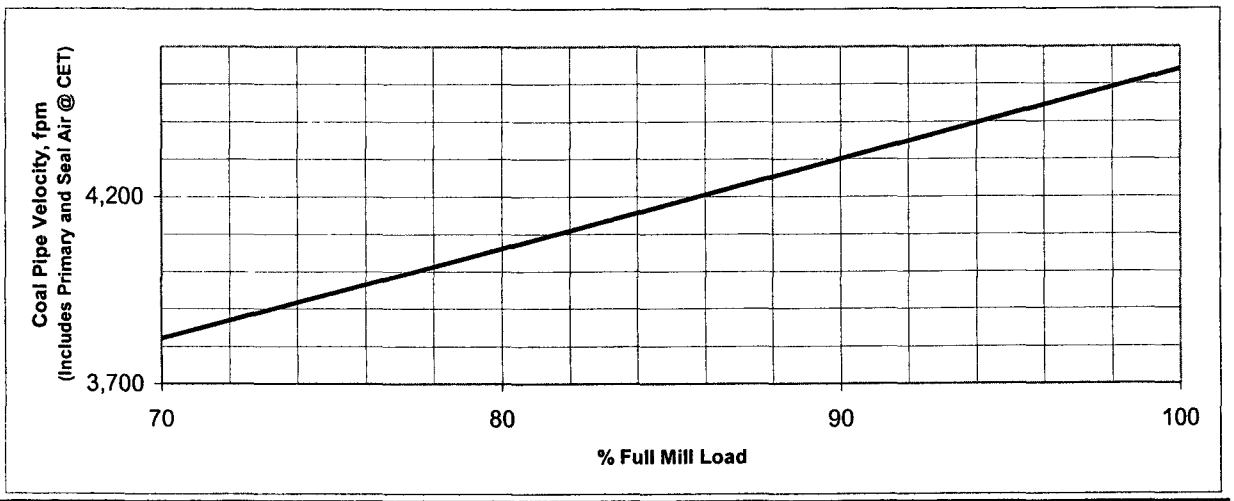
BABCOCK BORSIG POWER DB RILEY Version 1; CPS&A-CC.xls, June, 2000	COAL PIPE SIZING AND A/C CHARACTERIZATION Project: Intermountain Power Location: Delta, UT		Unit No #1
NOTES: Revised after post installation testing	Issued By: Q Lin	Calculation Date: 20-Dec-02	PROJECT NO. 350052







% full mill load	70	75	80	85	90	95	100
Coal flow, lb/hr	*89,600*	*96,000*	*102,400*	*108,800*	*115,200*	*121,600*	*128,000*
% primary air flow	84.3	86.9	89.5	92.1	94.8	97.4	100.0
Primary air flow, (PA), lb/hr	172,713	178,094	183,475	188,856	194,238	199,619	205,000

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Q.Lin
lab

FUELS LABORATORY

Test Report

Laboratory No. 51646 **Sample of:** Pulverized Coal **Date Rec'd:** 11/24/03

Received From: Intermountain Power Services Co.; Delta, Utah

Sample Data: Pulverized Coal sample; 11/11/03; unit 1; "E"Mill; 1530

Contract No: 355028 **Field Sample by:**

Fineness:

Sample Number	51646
% Thru 50 Mesh	100.0
% Thru 100 Mesh	98.0
% Thru 200 Mesh	79.1
% Moisture	0.95

Methods: Fineness – ASTM D197

Date: 12/5/03

W. Stewart

RILEYPower
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Q. Lin
Lab

FUELS LABORATORY

Test Report

Laboratory No. 51645 **Sample of:** Coal **Date Rec'd:** 11/24/03

Received From: Intermountain power Service Co.; Delta, Utah

Sample Data: Coal sample unit 1; "E" Mill; 11/11/03; 1545-1605; meter inlet

Contract No: 355028 **Field Sample by:**

Air Drying Loss 6.80 %					
Proximate Analysis (ASTM D3172)	As Rec'd	Dry	Ultimate Analysis (ASTM D3176)	As Rec'd	Dry
Moisture (ASTM D3173)	8.73 %	---	Moisture (ASTM D3173)	8.73 %	--- %
Volatile (ASTM D3175)	37.38 %	40.95 %	Carbon (ASTM D5373)	62.99 %	69.01 %
Ash (ASTM D3174)	8.67 %	9.50 %	Hydrogen (ASTM D5373)	4.64 %	5.09 %
Fixed Carbon	45.22 %	49.55 %	Nitrogen (ASTM D5373)	1.15 %	1.26 %
	100 %	100 %	Oxygen	13.37 %	14.65 %
British Thermal Units (ASTM D5865)	11809	12939	Sulfur (ASTM D3177)	0.45 %	0.49 %
Fusibility of Ash(ASTM D1857)	Atmosphere		Ash (ASTM D3174)	8.67 %	9.50 %
	Oxid.	Red		100 %	100 %
Initial Deformation	°F	°F	Free Swelling Index (ASTM D720)		
Softening (H=W)	°F	°F	Grindability Index ASTM D409)	48.5	
Hemispherical (H=½W)	°F	°F	Grindability Moisture	1.5%	
Fluid	°F	°F			

Date: 12/5/03

W. Stewart

IP12_002138

2895

Darrell Dorman =: 508-854-4670

From: Dan Coates

Subj. T.P. Delta Mill Testing

Date: 7/2/03

Here is the testing data for the mills. Please review and advise if any additional data other than the local Dirty Air & Fineness data, is required.

1E mill is being tested today @ 80% feeder speed (54.4 T/hr) as this is maximum loading on the mill in it's present condition. 1E mill will be taken out of service on Monday July 7th for complete overhaul and new rotating throats.

Rotating Throat Comment: Why don't the new BPT throat segments look like the Technimonks (DB) throats?

Printed out for: AARON-N - 02-Jul-03 09:05:49
100 Messages U1 Pulv U1 Pulv Operating ta Pre Retrofit 02-Jul-03 09:0

Unit 1 950.3 MW	Pulv A	Pulv B	Pulv C	Pulv D	Pulv E	Pulv F	Pulv G	Pulv H
Coal Flow384.7TPH	49.6	51.2	21.5	52.1	50.6	50.3	50.2	46.0
Feeder Speed	72.9	75.3	31.3	76.6	74.0	74.0	73.3	65.6
Amps (Duct Pr44.6	69.9	56.5	62.2	59.4	72.5	66.0	50.2	48.7
Coal Pipe Vel	4306.	4015.	3852.	4138.	4147.	4174.	4337.	3721.
PA Flow %	97.6	89.6	86.7	92.3	93.8	95.0	97.5	84.9
PA Damper Pos	88.1	81.6	72.3	76.3	83.6	82.2	75.9	72.8
Pulv Pitot DP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PA Mass Flow Air monitor	3860.	3581.	3409.	3683.	3728.	3729.	3874.	3359.
Pulv DP (NOx 0.39	20.3	16.7	17.6	18.2	17.8	18.5	11.1	11.6
Air to Fuel Ratio	2.35	2.06	3.89	2.11	2.20	2.20	2.26	2.17
Pulv Inlet Temp	291.6	312.2	264.8	300.6	303.5	307.6	301.0	332.4
Pulv Outlet Temp	147.3	150.6	153.3	149.4	149.4	148.8	150.1	150.6
Coal Bias	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Air Bias	9.4	0.0	10.2	5.4	5.1	5.1	7.2	0.0
Hyd Skid Pr Fdbk	2138.	2228.	0.	1933.	2140.	2229.	2176.	1481.
Hyd Skid Pr Setpt	2222.	2283.	1188.	2295.	2233.	2249.	2247.	2091.

EndTim= 02-Jul-03 09:05:49 /EvalTim= 02-Jul-03 09:05:49 /PanRate= 0

IP12_002140

Unit 1	E Pulverizer	11/11/03 15:20	11/11/03 16:20
		Test 1	
1SGAPEFDRE	% Feeder Speed	90.35	
1COAXI006A	Actual Pulv Coal Flow (tph)	61.44	
1COAKS025A	PA Damper Position (%)	99.2	
1COAXI060A	PA Flow (%)	76.9	
1SGATE0643	PA Inlet Damper Temp (DEGF)	385.2	
1SGAPT0154	PA D/P (INWC)	27.313	
1COAXI068A	Disch Temp (DEGF)	151.370	
1SGAKK0005	Pulv Motor (amps)	76.397	
1SGBPE0060	PA Mass Flowrate (lb/min)	3100	
1SGBPE060R	air to fuel ratio	1.48	
1SGATZ009C	Pulv hrs since 30K Overhaul	2184	
1SGAPE1005	Pulv E amp swing	8.12	
1COAXI072A	PA Duct Pressure (INWC)	44.0	
1SGAPT0283	Hydraulic Skid Press FeedBack	2317	
1COAXI235A	Hydraulic Skid Press Set Pt	2400	
1inapt0227	Ambient Press	25.63	
1sgbpe060v	PA Velocity (ft/min)	3483.56	
1COAXI027A	Unit Load (mw)	949.93	
1coaxi023a	Steam Flow (FFW + Sprays)	6798.19	KPPH
1COAXI012A	Main Steam Pressure	2402.13	PSIG
1sgbte1065	Fan Room Temp	63.84	Deg F
1SGBPT0256	Sec Air Duct Press East	4.05	in wc
1SGBPT0257	Sec Air Duct Press West	4.47	in wc
1SGAPT0176	E Windbox Press	2.53	in wc
9wt-rh	Relative Humidity	53.88	%

Printed out for: UNIT1OP - 11-Nov-03 16:25:00

0 Messages U1 Pulv U1 Pulv Operating data 11-Nov-03 16:25:00

Unit 1 947.0 MW	Pulv A	Pulv B	Pulv C	Pulv D	Pulv E	Pulv F	Pulv G	Pulv H
Coal Flow375.4TPH	47.7	54.0	52.8	53.1	61.4	0.2	52.0	54.6
Feeder Speed	70.2	76.8	76.9	78.8	90.7	0.2	76.8	79.6
Amps (Duct Pr44.1)	70.9	58.4	68.2	60.2	71.4	0.0	50.9	62.2
Coal Pipe Vel	4083.	4003.	3963.	3995.	3451.	0.	4226.	4178.
PA Flow %	92.7	90.3	89.7	90.0	77.8	0.0	96.3	94.9
PA Damper Pos	75.3	82.2	72.7	71.6	100.	1.3	78.7	84.4
SA Damper Pos	66.1	74.4	75.6	74.7	88.5	44.9	74.1	75.1
PA Mass Flow	3663.	3585.	3553.	3583.	3092.	0.	3813.	3738.
Pulv DP (NOx 0.36)	13.5	14.9	12.6	14.7	26.7	0.0	11.3	18.3
Air to Fuel Ratio	2.32	2.02	2.04	2.04	1.50	0.00	2.20	2.07
Pulv Inlet Temp	312.0	330.5	329.0	315.2	389.1	87.4	296.0	354.9
Pulv Outlet Temp	149.7	151.5	150.6	151.9	151.1	88.0	150.9	150.0
Coal Bias	-6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Air Bias	4.8	0.0	0.0	0.0	0.0	0.0	5.1	4.1
Hyd Skid Pr Fdbk	2342.	2290.	2297.	2266.	2317.	2.	2239.	2290.
Hyd Skid Pr Setpt	2154.	2387.	2341.	2351.	2400.	1149.	2313.	2400.

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IP12_002142

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70% end of test

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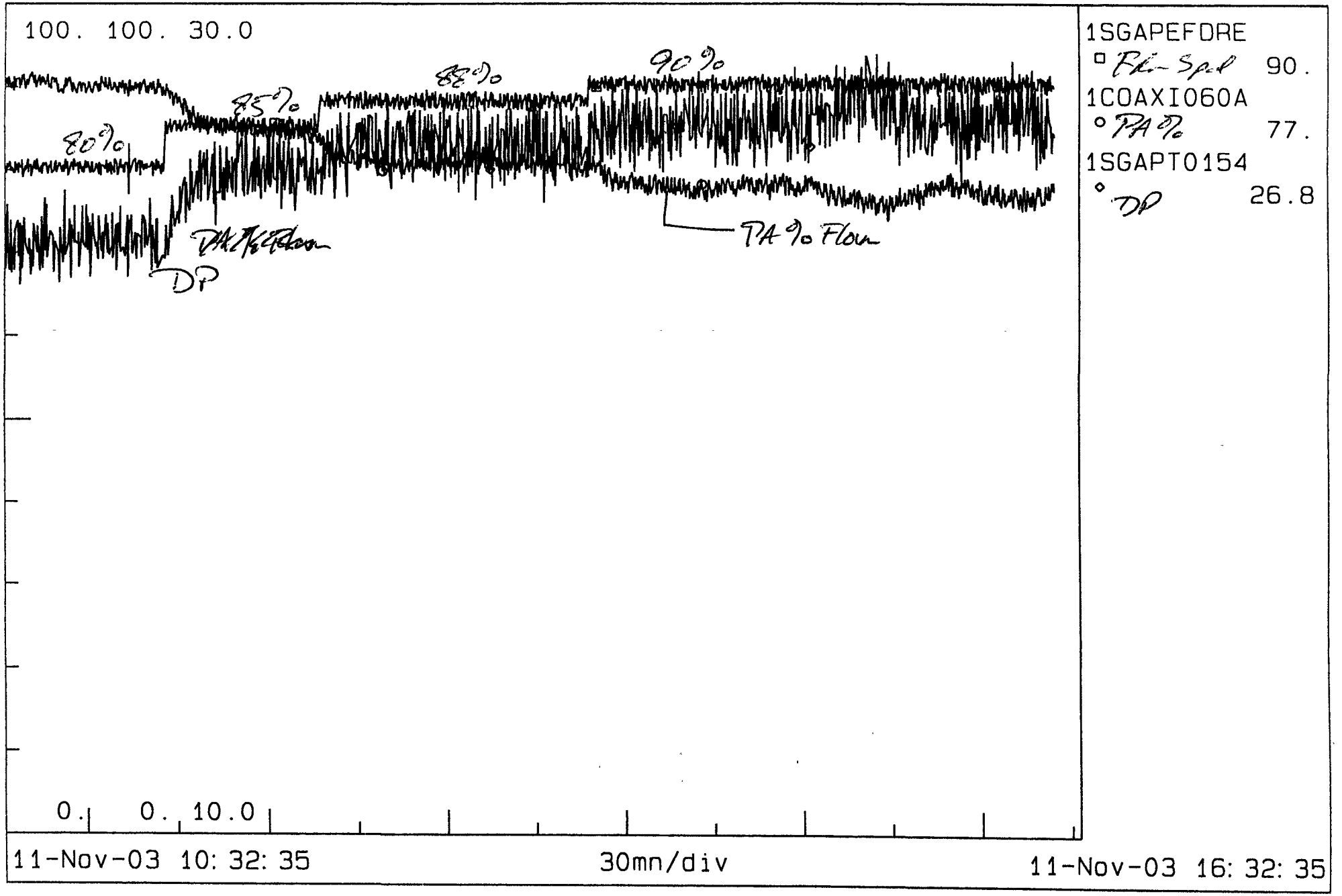

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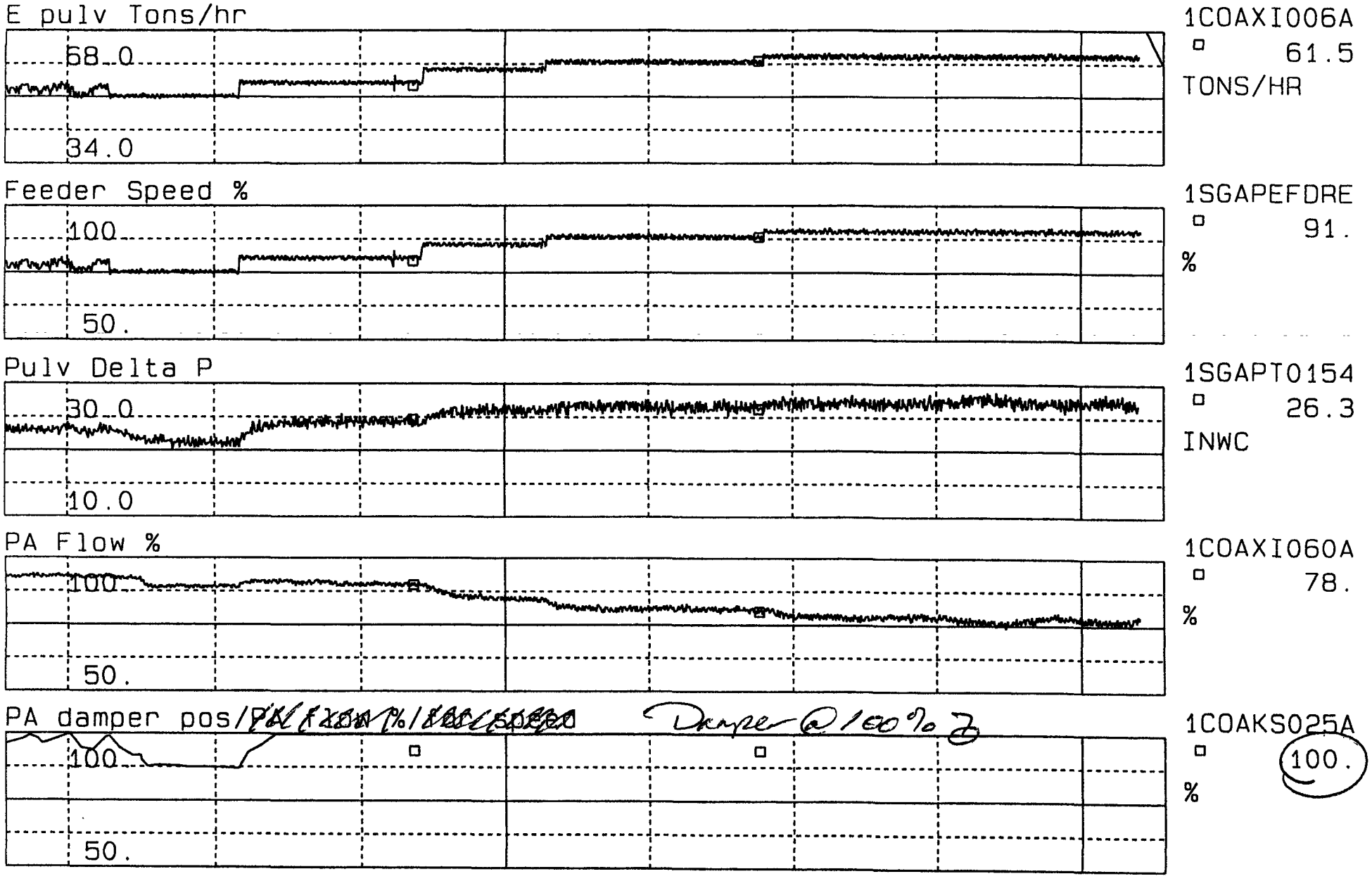
IP12_002143

Printed out for: UNIT10P - 11-Nov-03 16:24:24

90% End of Test

0 Messages GARRY'S2 TEST PAGE

11-Nov-03 16:24:24



11-Nov-03 08:34:01 11-Nov-03 16:34:01 1hr/div 11-Nov-03 16:34:01

IP12_002144

Printed out for: UNIT1OP - 11-Nov-03 15: 06: 49

90% Fly Ash

0 Messages U1 Pulv U1 Pulv Operating data 11-Nov-03 15: 06: 49

Unit 1 947.5 MW	Pulv A	Pulv B	Pulv C	Pulv D	Pulv E	Pulv F	Pulv G	Pulv H
Coal Flow372.7TPH	46.8	53.9	52.3	52.1	61.4	0.2	51.6	54.0
Feeder Speed	68.9	78.8	77.0	77.6	89.9	0.2	76.1	79.0
Amps (Duct Pr44.2)	68.2	57.7	64.5	61.0	77.0	0.0	50.7	61.9
Coal Pipe Vel	4082.	3958.	3941.	4009.	3428.	0.	4212.	4114.
PA Flow %	92.7	90.3	89.8	89.9	77.4	0.0	95.6	94.1
PA Damper Pos	75.3	82.4	72.7	71.7	100.	1.3	80.4	83.9
SA Damper Pos	65.6	73.9	75.3	74.3	88.8	44.8	73.7	74.6
PA Mass Flow	3658.	3542.	3531.	3555.	3097.	0.	3772.	3743.
Pulv DP (NOx 0.36)	13.5	15.3	12.5	15.3	27.2	0.0	11.4	17.9
Air to Fuel Ratio	2.25	1.97	2.00	1.99	1.52	0.00	2.16	2.01
Pulv Inlet Temp	312.0	330.4	327.7	319.6	383.3	86.3	295.2	353.6
Pulv Outlet Temp	150.9	151.9	151.4	152.3	151.1	87.5	151.4	150.4
Coal Bias	-6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Air Bias	4.8	0.0	0.0	0.0	0.0	0.0	5.1	4.1
Hyd Skid Pr Fdbk	2349.	2289.	2296.	2258.	2318.	2.	2162.	2298.
Hyd Skid Pr Setpt	2119.	2381.	2322.	2297.	2400.	1149.	2299.	2384.

EndTim= 11-Nov-03 15: 06: 49 /EvalTim= 11-Nov-03 15: 06: 49 /PanRate= 0

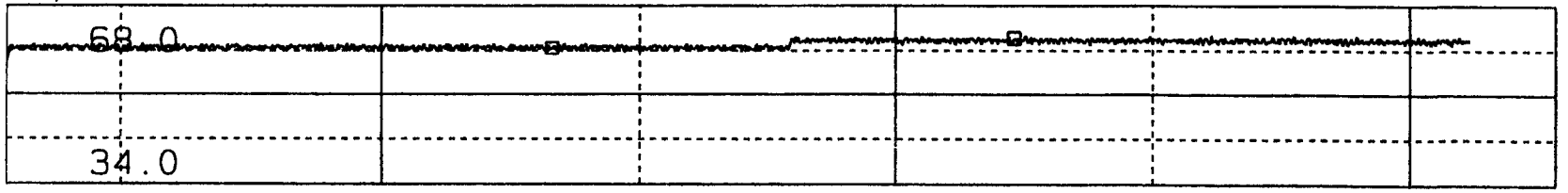
Printed out for: UNIT1OP - 11-Nov-03 15: 06: 59

0 Messages GARRY'S2 TEST PAGE

PC To Fdr Spd

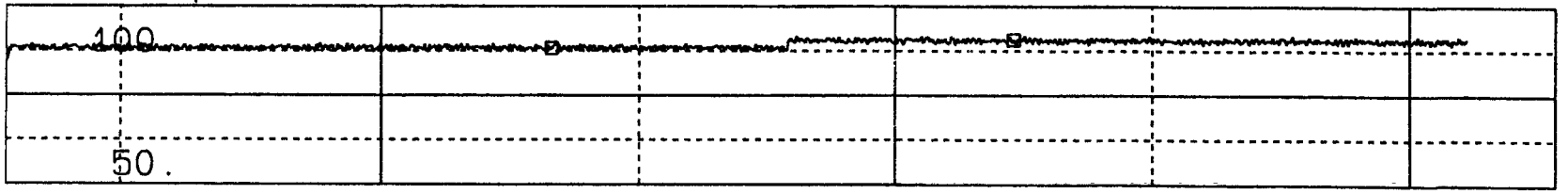
11-Nov-03 15: 06: 59

E pulv Tons/hr



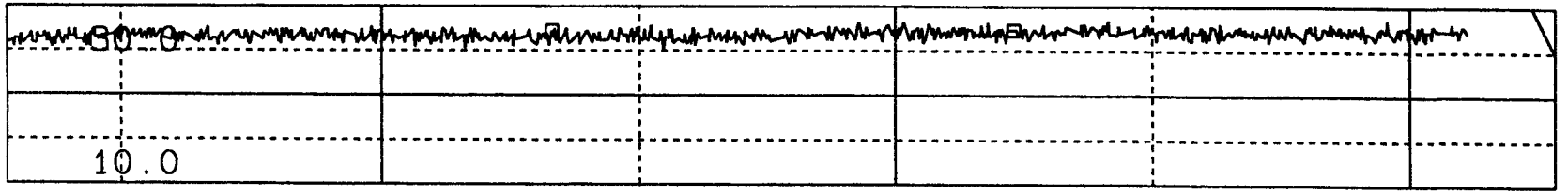
1COAXI006A
61.6
TONS/HR

Feeder Speed %



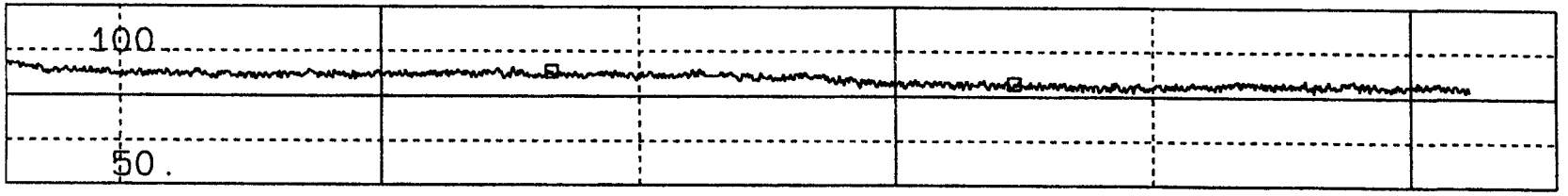
1SGAPEFDRE
90.
%

Pulv Delta P



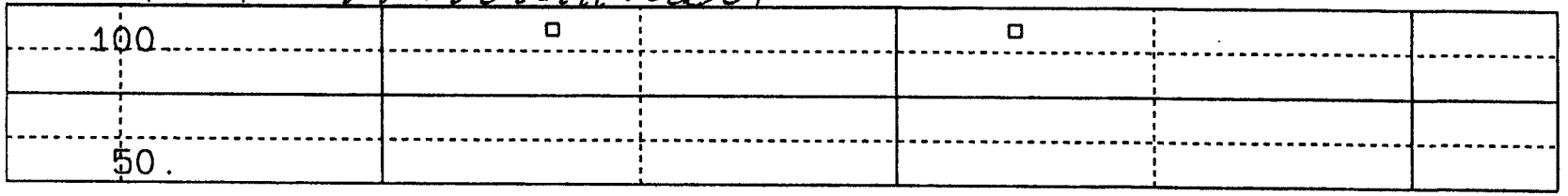
1SGAPT0154
27.2
INWC

PA Flow %



1COAXI060A
77.
%

PA damper pos/PA/~~FLOW~~ %/Fdr speed



1COAKS025A
100.
%

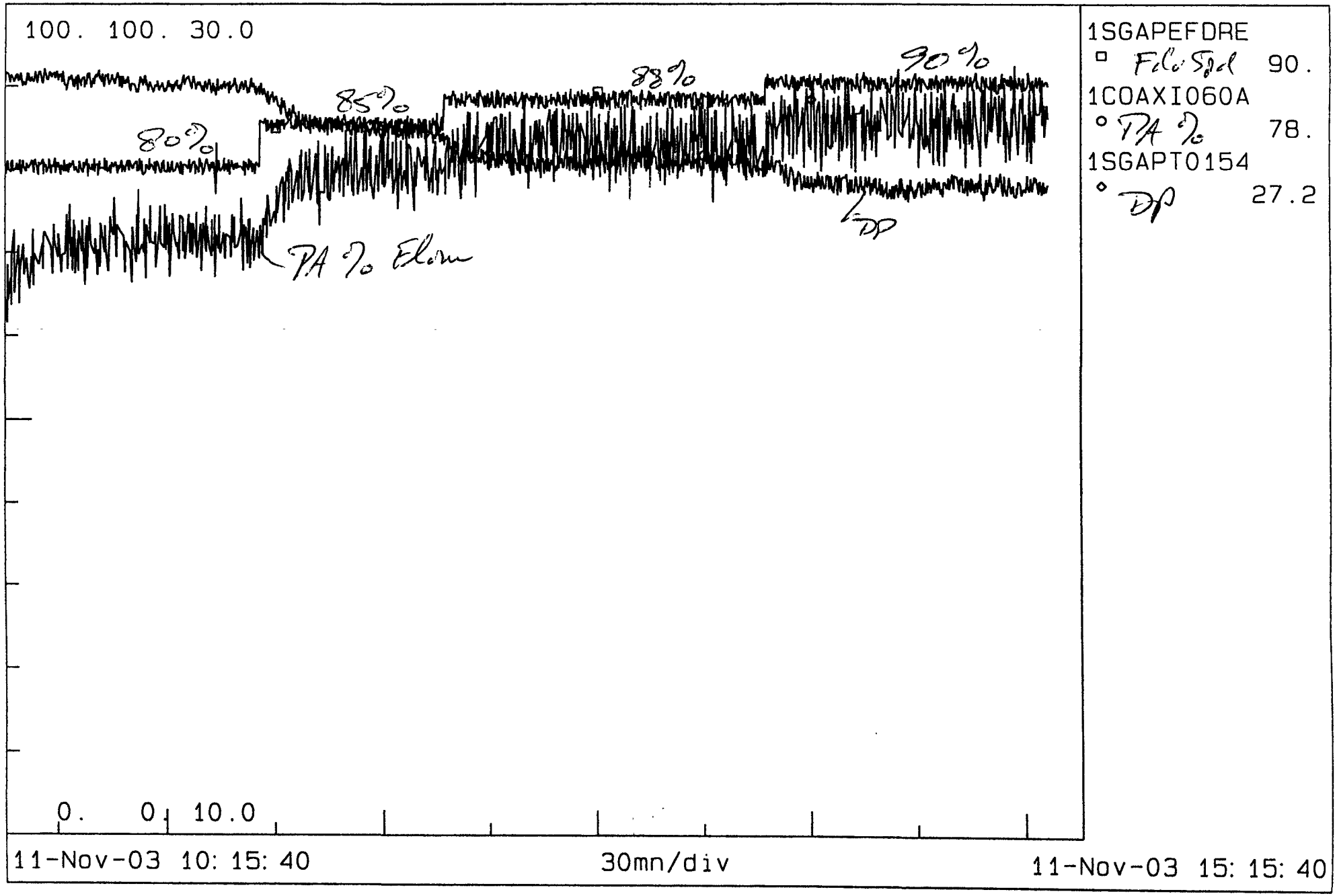
11-Nov-03 12: 16: 51 11-Nov-03 15: 16: 51 30mn/div 11-Nov-03 15: 16: 51

IP12_002146

Printed out for: UNIT1OP - 11-Nov-03 15: 06: 39

0 Messages U1 Pulv U1 Pulv Operating data

11-Nov-03 15: 06: 39



EndTim= 11-Nov-03 15: 06: 39 /EvalTim= 11-Nov-03 15: 06: 39 /PanRate= 0

IP12_002147

Printed out for: UNIT1OP - 11-Nov-03 13:40:02 88%

0 Messages U1 Pulv U1 Pulv Operating data RPE Throat Test 11-Nov-03 13:40:02

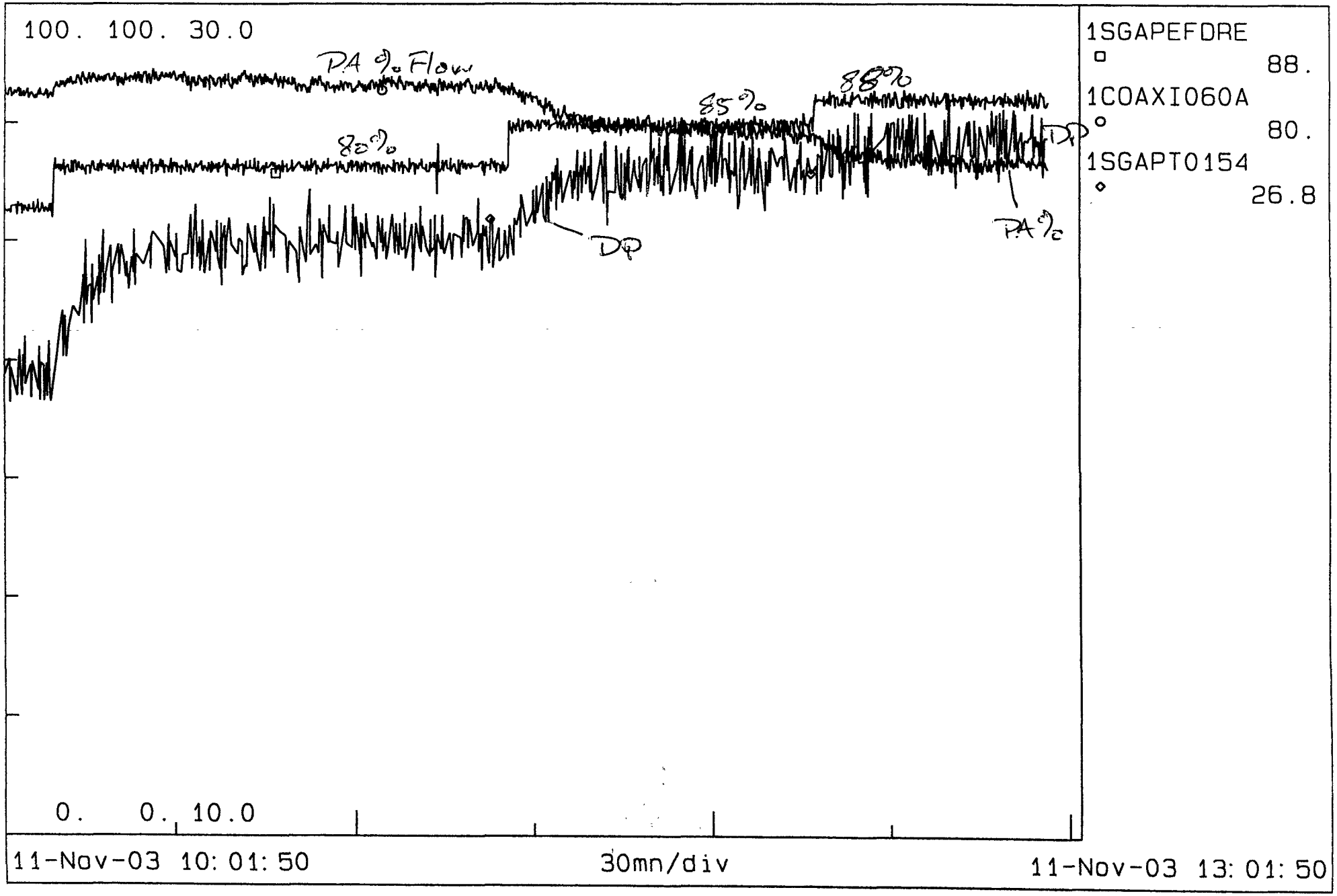
Unit 1 952.0 MW	Pulv A	Pulv B	Pulv C	Pulv D	Pulv E	Pulv F	Pulv G	Pulv H
Coal Flow369.0TPH	46.8	52.9	53.3	52.7	60.1	0.2	51.5	53.7
Feeder Speed	69.8	79.2	77.2	76.3	88.9	0.2	75.9	77.7
Amps (Duct Pr43.9)	73.0	59.7	68.4	59.7	73.2	0.0	50.0	62.4
Coal Pipe Vel	4074.	3996.	3957.	3969.	3553.	0.	4198.	4160.
PA Flow %	93.1	90.0	89.1	89.5	80.2	0.0	94.3	93.7
PA Damper Pos	74.6	81.9	72.2	71.2	100.	1.3	80.5	83.8
SA Damper Pos	64.8	73.0	74.6	73.3	87.3	44.8	72.8	73.8
PA Mass Flow	3657.	3579.	3548.	3525.	3183. 190986 pph	0.	3761.	3693.
Pulv DP (NOx 0.35)	13.6	15.3	12.2	14.7	26.8	0.0	11.5	18.2
Air to Fuel Ratio	2.34	2.04	2.08	2.04	1.59	0.00	2.22	2.11
Pulv Inlet Temp	298.7	325.7	323.6	315.0	374.0	84.2	298.7	357.1
Pulv Outlet Temp	150.8	151.9	151.1	151.9	150.9	87.3	151.3	150.9
Coal Bias	-6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Air Bias	4.8	0.0	0.0	0.0	0.0	0.0	5.1	4.1
Hyd Skid Pr Fdbk	2348.	2292.	2297.	2258.	2318.	2.	2245.	2290.
Hyd Skid Pr Setpt	2119.	2343.	2360.	2344.	2400.	1149.	2290.	2373.

EndTim= 11-Nov-03 13:40:02 /EvalTim= 11-Nov-03 13:40:02 /PanRate= 0

IP12_002148

Printed out for: UNIT1OP - 11-Nov-03 13: 41: 20

0 Messages U1 Pulv U1 Pulv Operating data 11-Nov-03 13: 41: 20



EndTim= 11-Nov-03 13: 41: 20 /EvalTim= 11-Nov-03 13: 41: 20 /PanRate= 0

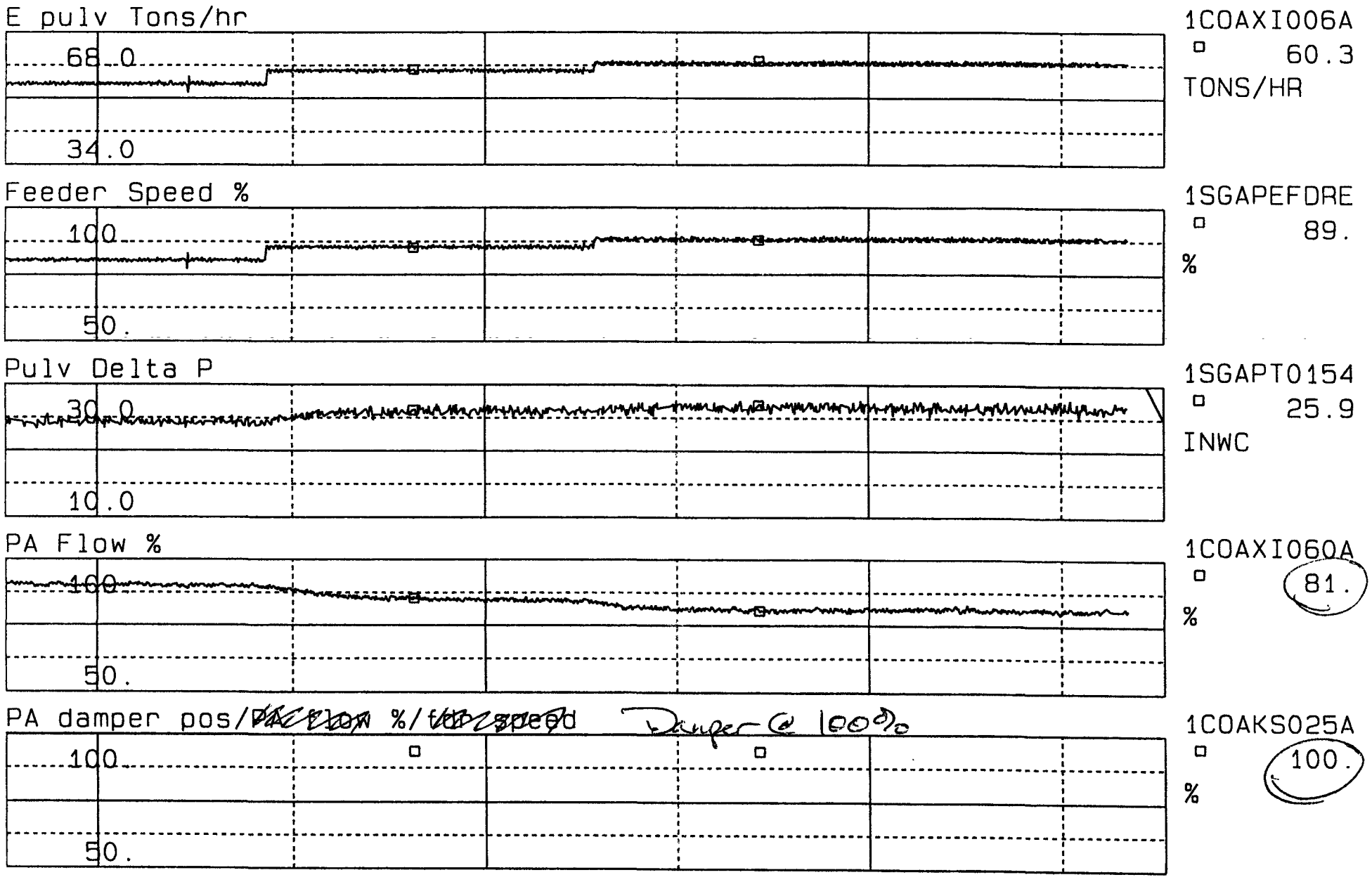
IP12_002149

Printed out for: UNIT10P - 11-Nov-03 13: 40: 21

88%

0 Messages GARRY'S2 TEST PAGE

11-Nov-03 13: 40: 21

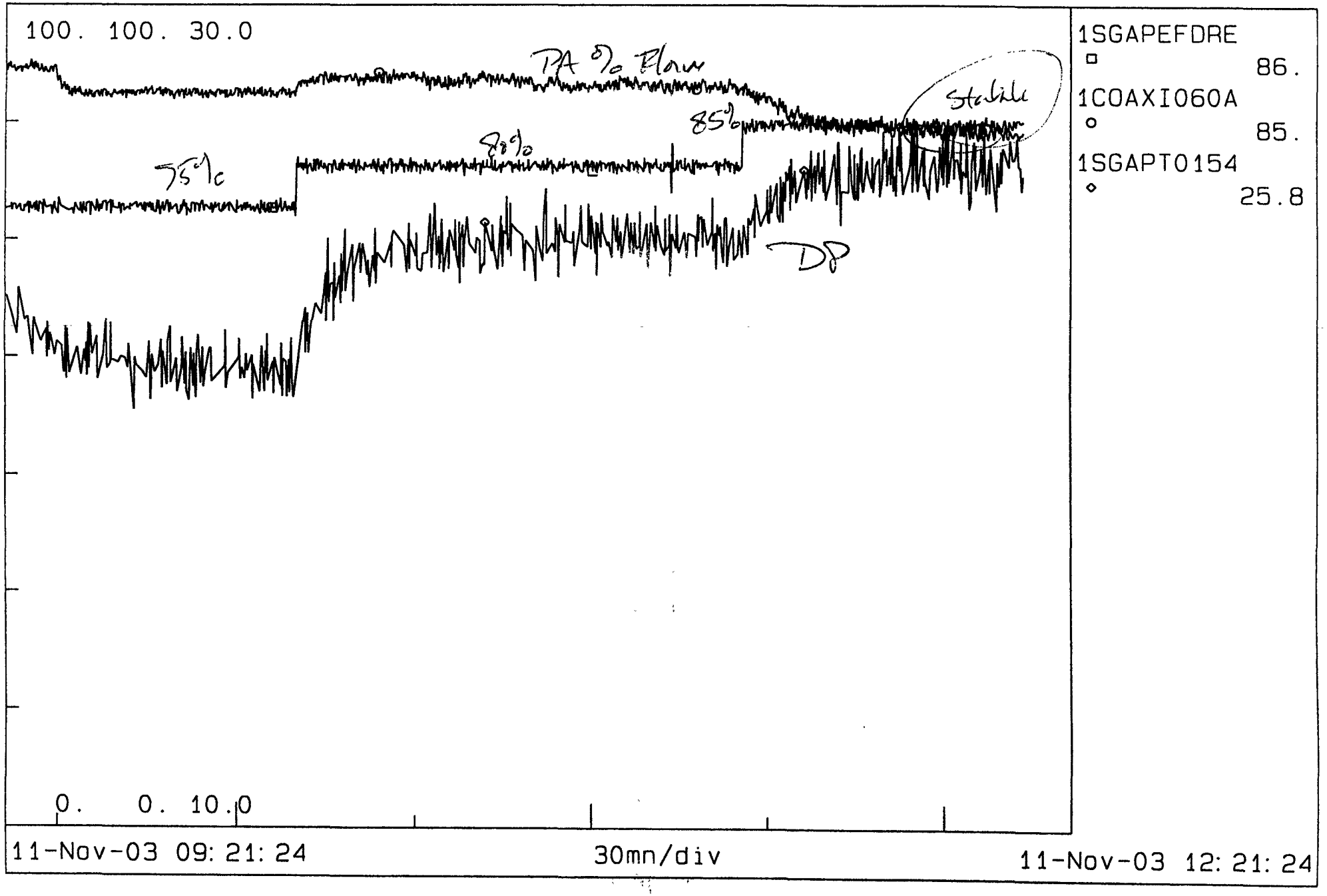


IP12_002150

Printed out for: UNIT1OP - 11-Nov-03 12: 13: 39

85% Stable

0 Messages U1 Pulv U1 Pulv Operating data 11-Nov-03 12: 13: 39



EndTim= 11-Nov-03 12: 13: 39 /EvalTim= 11-Nov-03 12: 13: 39 /PanRate= 0

IP12_002151

Printed out for: UNIT1OP - 11-Nov-03 12: 13: 52 ~85% Rdr Spd

0 Messages U1 Pulv U1 Pulv Operating data 11-Nov-03 12: 13: 52

Unit 1 949.5 MW	Pulv A	Pulv B	Pulv C	Pulv D	Pulv E	Pulv F	Pulv G	Pulv H
Coal Flow368.9TPH	46.8	53.3	52.4	52.5	58.3	0.2	51.1	54.0
Feeder Speed	68.5	79.7	76.7	77.5	85.8	0.2	75.7	77.7
Amps (Duct Pr44.1)	69.0	59.5	70.0	58.7	71.7	0.0	51.4	62.0
Coal Pipe Vel	4098.	3965.	3937.	3951.	3697.	0.	4216.	4128.
PA Flow %	92.4	90.2	89.2	89.7	83.7	0.0	94.9	93.8
PA Damper Pos	75.7	82.1	72.4	71.1	100.	1.3	76.5	84.0
SA Damper Pos	64.7	72.9	74.4	73.1	84.1	44.8	72.6	73.7
PA Mass Flow	3682.	3555.	3533.	3540.	3322. 199320	0.	3739.	3708.
Pulv DP (NOx 0.38)	13.5	15.6	12.6	15.6	25.8	0.0	10.5	17.8
Air to Fuel Ratio	2.36	2.01	2.04	2.03	1.72	0.00	2.17	2.06
Pulv Inlet Temp	305.3	322.1	321.1	310.8	355.5	81.9	315.9	357.7
Pulv Outlet Temp	150.1	151.5	150.9	151.9	150.1	87.3	151.3	150.3
Coal Bias	-6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Air Bias	4.8	0.0	0.0	0.0	0.0	0.0	5.1	4.1
Hyd Skid Pr Fdbk	2348.	2292.	2297.	2258.	2318.	2.	2258.	2287.
Hyd Skid Pr Setpt	2124.	2358.	2325.	2309.	2400.	1149.	2279.	2387.

EndTim= 11-Nov-03 12: 13: 52 /EvalTim= 11-Nov-03 12: 13: 52 /PanRate= 0

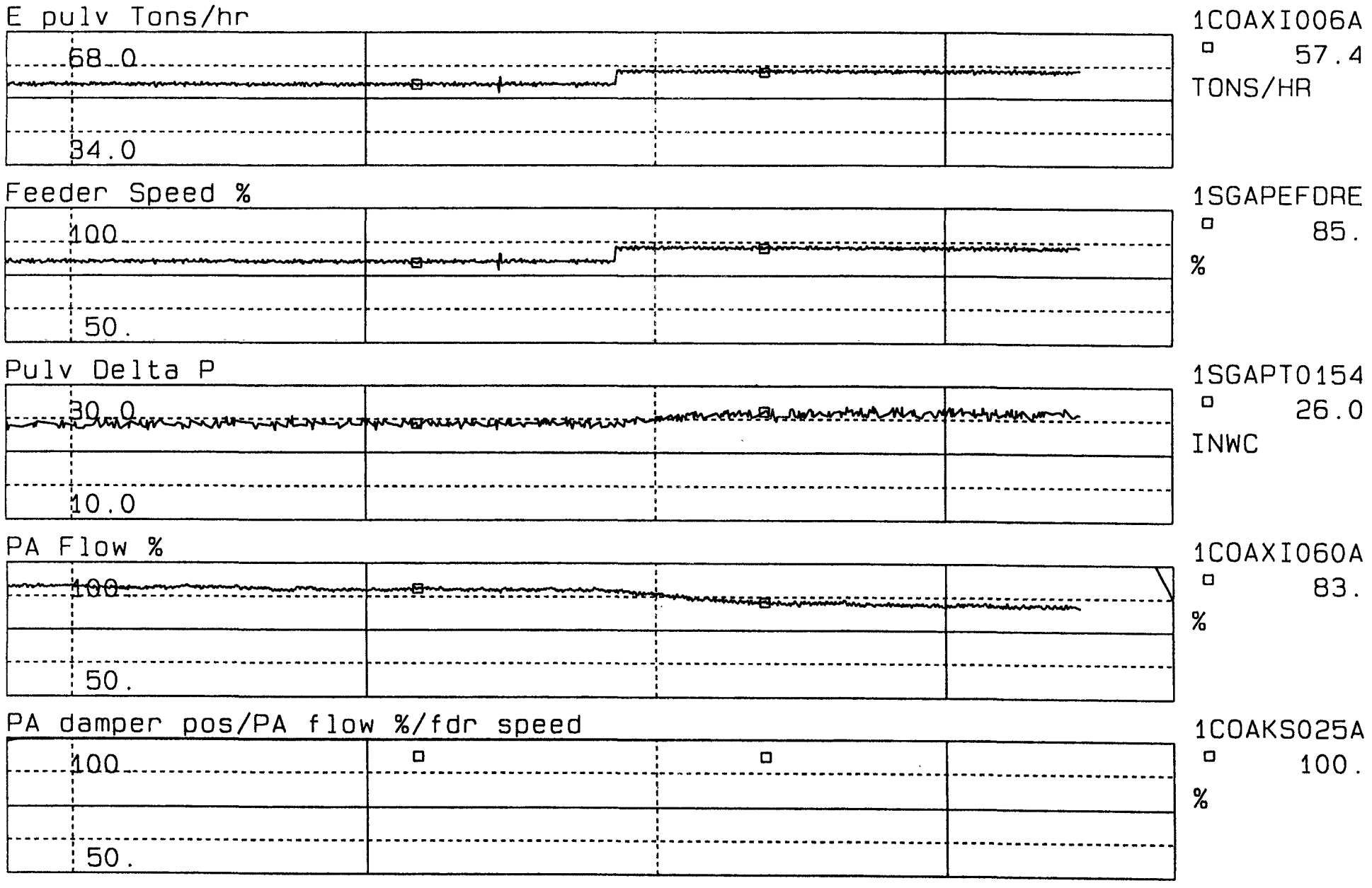
IP12_002152

Printed out for: UNIT10P - 11-Nov-03 12: 14: 07

0 Messages GARRY'S2 TEST PAGE

85% Split

11-Nov-03 12: 14: 07



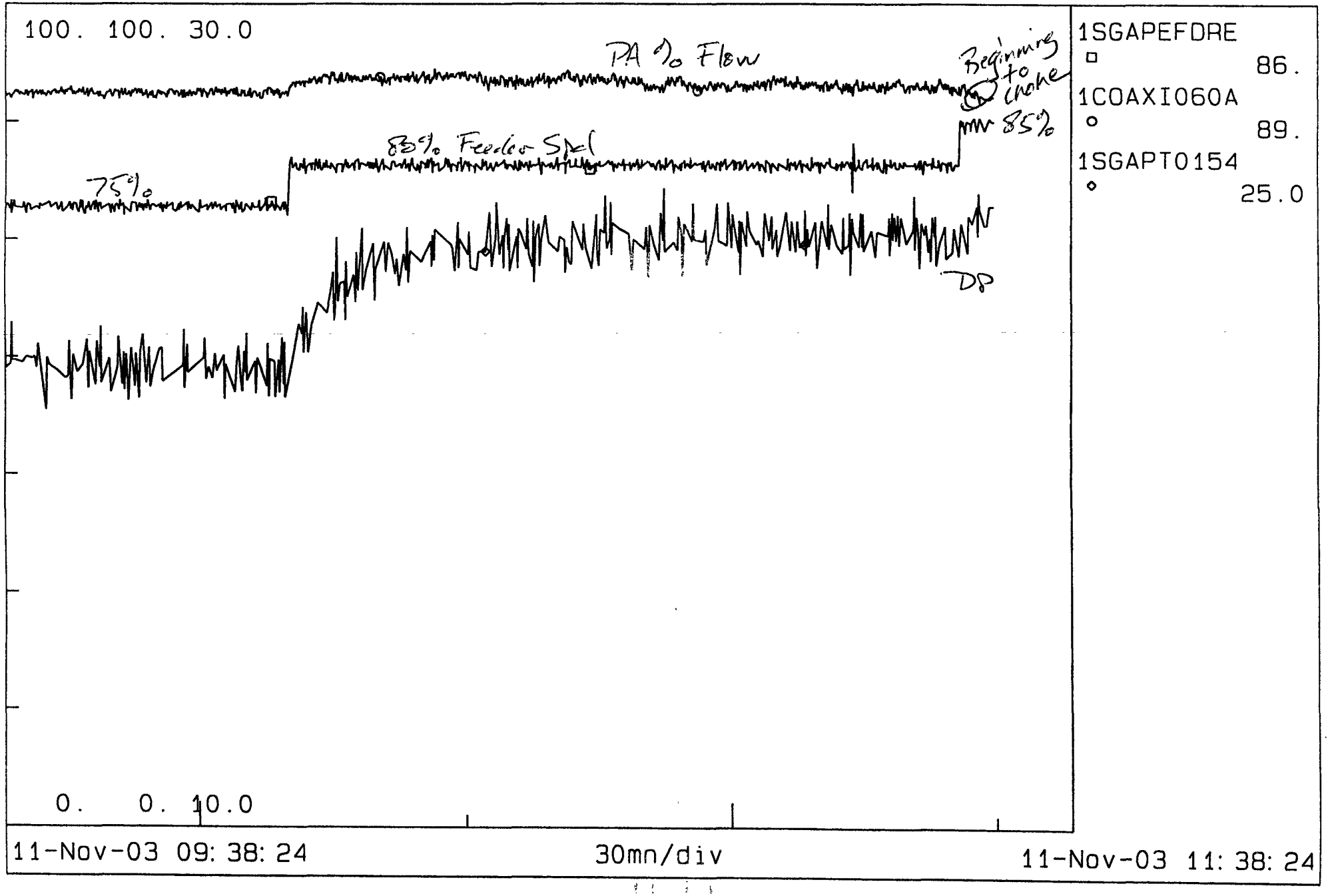
11-Nov-03 10: 23: 18 11-Nov-03 12: 23: 18 30mn/div 11-Nov-03 12: 23: 18

IP12_002153

Printe[redacted]out for: UNIT1OP - 11-Nov-03 11:29:55

85[redacted]

0 Messages U1 Pulv U1 Pulv Operating data 11-Nov-03 11:29:55



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IP12_002154

Printed out for: UNIT1OP - 11-Nov-03 11:23:57 80% Fdr Spd. Stable

0 Messages U1 Pulv U1 Pulv Operating data BPR Throat 11-Nov-03 11:23:57

Unit 1 951.5 MW	Pulv A	Pulv B	Pulv C	Pulv D	Pulv E	Pulv F	Pulv G	Pulv H
Coal Flow369.8TPH	47.6	53.2	51.6	53.6	55.1	0.2	52.0	54.5
Feeder Speed	71.0	79.8	77.9	78.1	80.2	0.2	77.5	78.9
Amps (Duct Pr44.2)	72.4	58.7	71.0	59.9	71.4	0.0	50.7	61.7
Coal Pipe Vel	4009.	4010.	3963.	3981.	3957.	0.	4188.	4161.
PA Flow %	91.9	90.8	89.7	90.5	90.1	0.0	94.3	94.6
PA Damper Pos	76.0	82.6	72.8	71.9	100.	1.3	81.9	84.7
SA Damper Pos	65.3	73.6	75.1	73.8	79.7	44.9	73.3	74.3
PA Mass Flow	3611.	3596.	3555.	3568.	3546.	0.	3797.	3742.
Pulv DP (NOx 0.35)	14.7	15.3	12.9	15.7	24.3	0.0	12.0	18.4
Air to Fuel Ratio	2.30	2.01	2.01	2.01	1.96	0.00	2.19	2.06
Pulv Inlet Temp	310.0	323.6	323.6	309.5	331.8	80.6	304.6	358.0
Pulv Outlet Temp	150.6	151.5	151.4	151.9	151.4	87.2	151.3	149.7
Coal Bias	-6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Air Bias	4.8	0.0	0.0	0.0	0.0	0.0	5.1	4.1
Hyd Skid Pr Fdbk	2345.	2293.	2296.	2268.	2315.	3.	2267.	2288.
Hyd Skid Pr Setpt	2150.	2355.	2297.	2375.	2394.	1149.	2311.	2400.

EndTim= 11-Nov-03 11:23:57 /EvalTim= 11-Nov-03 11:23:57 /PanRate= 0

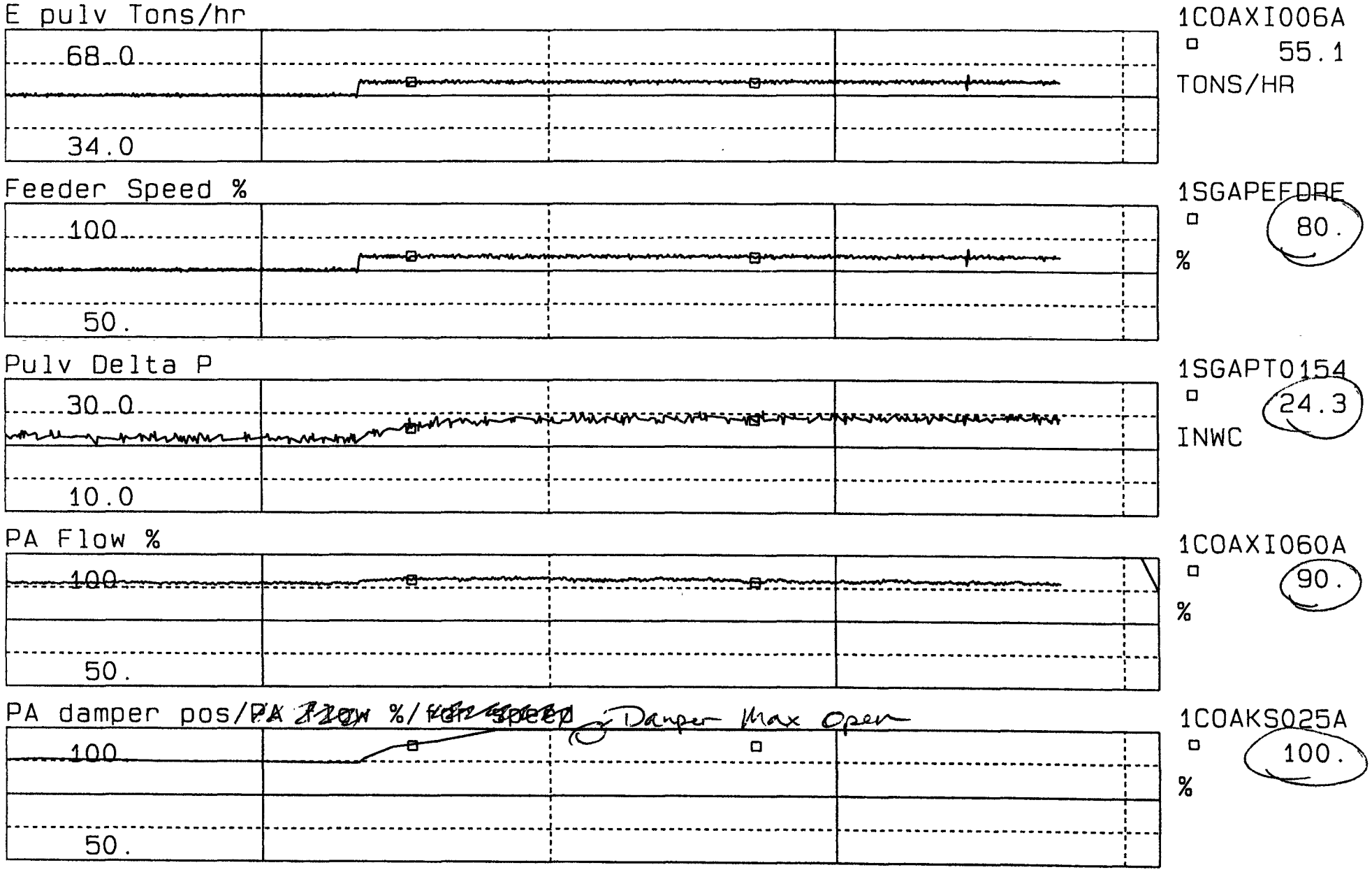
IP12_002155

Printed out for: UNIT10P - 11-Nov-03 11:23:46

0 Messages GARRY'S2 TEST PAGE

80% Fdr Spd. Stable

11-Nov-03 11:23:46



11-Nov-03 09:33:35 11-Nov-03 11:33:35 30mn/div 11-Nov-03 11:33:35

IP12_002156

Printed out for: UNIT1OP - 11-Nov-03 10:09:09

15 10 8'4 8a Stable

0 Messages U1 Pulv U1 Pulv Operating data BPD Throats 11-Nov-03 10:09:09

Unit 1 945.5 MW	Pulv A	Pulv B	Pulv C	Pulv D	Pulv E	Pulv F	Pulv G	Pulv H
Coal Flow369.6TPH	49.0	55.3	54.3	53.8	51.3	0.2	53.4	55.1
Feeder Speed	72.2	81.5	79.8	80.5	74.9	0.2	78.5	81.0
Amps (Duct Pr44.1)	71.9	59.5	66.7	62.4	70.5	0.0	50.4	61.9
Coal Pipe Vel	3949.	4026.	3973.	4003.	3938.	0.	4219.	4179.
PA Flow %	91.0	91.4	90.3	91.1	89.4	0.0	95.6	95.3
PA Damper Pos	76.9	82.8	73.4	72.7	86.6	1.3	79.3	86.2
SA Damper Pos	68.7	77.0	78.3	77.1	72.9	44.8	76.9	77.9
PA Mass Flow	3549.	3608.	3564.	3584.	3529.	0.	3792.	3756.
Pulv DP (NOx 0.35)	15.6	15.6	12.9	15.5	21.3	0.0	11.8	19.2
Air to Fuel Ratio	2.25	1.97	2.04	2.02	2.07	0.00	2.16	2.06
Pulv Inlet Temp	310.3	322.5	322.2	309.0	318.5	79.3	311.7	367.1
Pulv Outlet Temp	150.1	151.5	150.8	151.5	150.6	200.0	150.9	150.6
Coal Bias	-6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Air Bias	4.8	0.0	0.0	0.0	0.0	0.0	5.1	4.1
Hyd Skid Pr Fdbk	2344.	2288.	2297.	2258.	2146.	2.	2283.	2287.
Hyd Skid Pr Setpt	2203.	2400.	2396.	2393.	2262.	1149.	2363.	2400.

EndTim= 11-Nov-03 10:09:09 /EvalTim= 11-Nov-03 10:09:09 /PanRate= 0

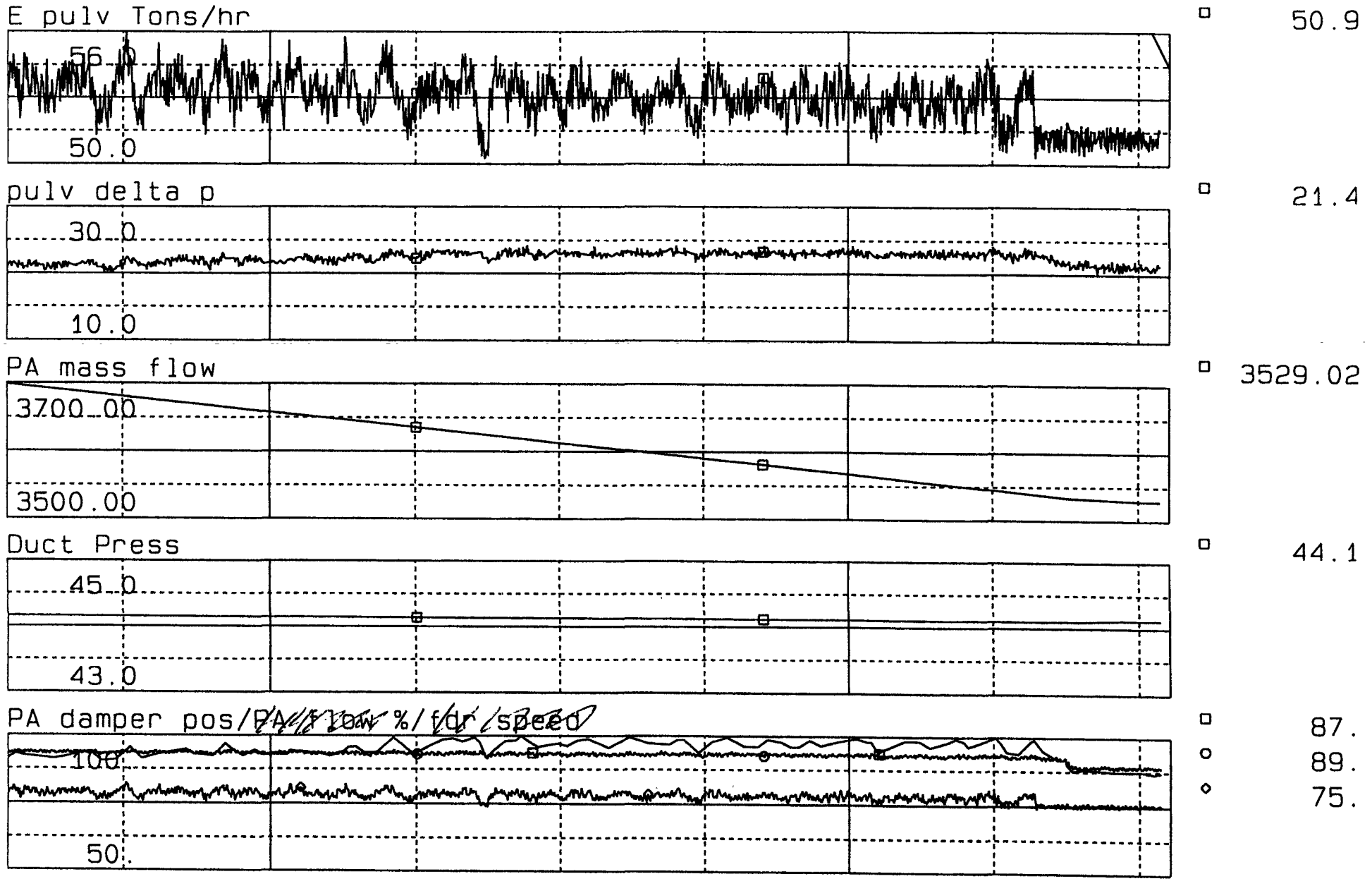
IP12_002157

Printed out for: UNIT10P - 11-Nov-03 10:08:36

0 Messages GARRY'S2 TEST PAGE

10/10 Winds Stable

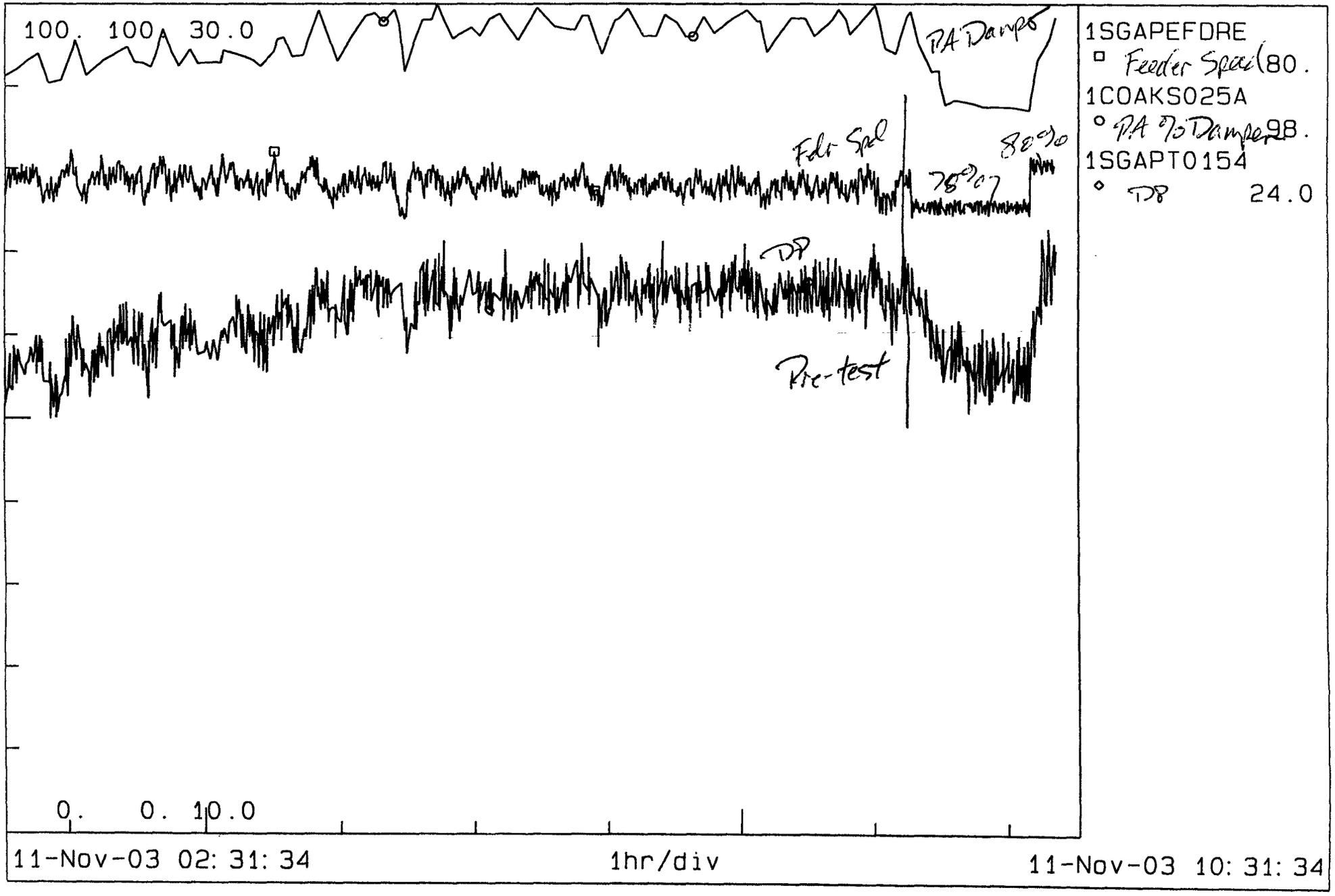
11-Nov-03 10:08:36



IP12_002158

Printe[redacted]out for: UNIT10P - 11-Nov-03 10:21:44

0 Messages U1 Pulv U1 Pulv Operating data 11-Nov-03 10:21:44



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IP12_002159